

## U.S. GEOLOGICAL SURVEY R/V FAY CRUISE 019

## Preliminary Cruise Report

Cruise Dates: 17 July to 4 August 1976

Ports: Charleston to Norfolk

Scientific Party: John Grow - Chief Scientist  
Perry Parks - Navigation/Gravity Engineer  
Dick Sylwester - Seismic Engineer  
Seismic Technicians - Rob Pexton and Jerry McCarthy  
Mechanical Technician - Felicity Oram  
Navigation Watch - Kathy Kent, Scott Heald, Dave Egelson,  
Clare Reimers  
Seismic Watch - Ralph Lewis, Barbara Tausey, Debbie Doyle,  
Lois Tomlinson, Norrie Robbins  
Cruise Data Curator: Barbara Tausey

Ships Officers: Captain - Peter Olander  
3rd Mate - Tom McSherry  
Chief Engineer - Larry Weeks  
3rd Engineers - Jim Corcoran, Leslie Bryan, Phil Trapasso  
Bosun - Paul Murray

Cruise Objectives:

This cruise was conducted between Charleston and Norfolk and concentrated on long geophysical profiles over the continental shelf, slope, and rise off of Cape Hatteras. Eight long profiles were collected transverse to the margin and two were collected parallel to the margin along the rise which tied into deep sea drilling sites #105 and 106 (see Figure 1). Two of the transverse lines went along previously purchased multichannel seismic data with the limited objective of collecting magnetic, gravity, and minisparker data to supplement the multi-channel common depth point (CDP) reflection data.

Cape Hatteras falls between the prospective oil and gas lease areas of Baltimore Canyon Trough and the South Georgia Embayment where more detailed surveys have already been completed. Therefore, the lines around Cape Hatteras represent a minimal grid for airgun, gravity, magnetic, and minisparker profiles which fills in the gap between the two lease areas.

Instrumentation:

(1) Airgun System - Single channel seismic reflection profiles were collected using a Seismic Engineering Inc. streamer with 40 acceleration cancelling multidyne (MDS) hydrophone transducers in a single active element of 300 foot length. The streamer has a 100 foot stretch section with up to 400 feet of faired lead-in cable. Normally, between 200-300 feet of lead-in cable were deployed. A depth transducer at the head of the active section allows the streamer depth to be measured; normally, it was towed at a depth of 35 to 40 feet.

Four airguns of variable chamber capacity were available ( 2 each PAR600B with 20 or 40 in<sup>3</sup> chambers and 2 each PAR1900C with 80 or 160 in<sup>3</sup> chambers). During FAY 019, one 40 in<sup>3</sup> gun was usually used on the shelf, while the 80 or 160 in<sup>3</sup> guns were used in deeper water.

Filter settings for deep water work were usually between 16-60 Hz with 3 to 4 seconds of penetration frequently being obtained. The recorders were on a 5 second sweep on most occasions with up to a 5 second delay in deep water. Firing rates varied from 5 to 15 seconds. On a few occasions, 2 second sweep and firing intervals were tried in shallow water.

The four compressors leased from Price Compressor, Inc. allowed continuous operation without any loss time due to compressor failures.

Generally speaking, the single channel reflection profiles for FAY 019 were outstanding with excellent resolution of basement and the deeper Mesozoic horizons throughout the Western Atlantic.

(2) Minisparker - A new Teledyne 600 joule minisparker system was installed aboard the R/V FAY for FAY 019. Generally, this system was operated on the EPC Curley recorders on 1/2 second sweep with a 1 second repetition rate. These were generally filtered between 280-1060 Hz and beautiful records were obtained, even in water depths up to 5 km. Penetrations of 200-300 msec was common and in a few cases the sweep had to be lengthened to 1 sec because more than 500 msec of penetration was obtained. This system was an outstanding success which will provide valuable new high resolution control on the upper 500 meters of the sediment column.

(3) 3.5 kHz Echosounder - This system was in an O.R.E. fish and was towed off the port side at a depth of about 5 meters. A Raytheon CESP II pulse correlation system and automatic digital tracking system were employed. In general, this system failed to obtain any subbottom reflections (even on the continental shelf) and was of no value even as an echosounder in deep water. The digital tracking gate was used on numerous occasions but failed so frequently that we finally shut it off. The 3.5 kHz system data can be used for bathymetry in shallow water, but the minisparker data will have to be used for deep water bathymetry.

(4) Geometrics Magnetic Gradiometer - The Geometrics Gradiometer tows two proton precession magnetometers on a single cable at <sup>1000 and 1500</sup> ~~500 and 100~~ feet behind the ship. The total magnetic field of the aft bottle and their difference were recorded on a Hewlett Packard chart recorder and on digital magnetic tape (parts of the Integrated Navigation System).

The noise level on the two sensors was generally between  $\pm 2$  to 3 gammas, which was quite a bit higher than expected. In spite of all efforts to tune and adjust the system, this noise level persisted. The symptoms were relayed back to Woods Hole and Kim Klitgord was going to try some additional improvements during FAY 020.

(5) Gravity - The R/V FAY was equipped with a gravity van containing a vibrating string gravity meter mounted on a Mark 19 Sperry gyrostabilized platform, on loan from Carl O. Bowin at Woods Hole Oceanographic Institution (on an Office of Naval Research grant). This system operated flawlessly during all of FAY 019.

(6) Analog Seismic Recording System - During FAY 019, the minisparker was generally recorded on the EPC Curley 19-inch dry paper recorders. The 3.5 kHz sonar and airgun records were generally on either of two Raytheon 19-inch dry paper recorders.

Magnetic tapes of airgun, minisparker, and 3.5 kHz systems were also recorded on 3600 ft analog tapes on a seven track Honeywell system.

(7) Integrated Navigation System (INS) - A new Integrated Navigation System was installed aboard the R/V FAY during February. This system was contracted through Western Geophysical Inc. and contains the following major subsystems:

- a. Satellite Receiver
- b. Teledyne Range-Range LORAN C unit
- c. Rubidium Frequency Standard
- d. Doppler Sonar - not installed
- e. Mark 29 gyrocompass
- f. Hewlett Packard 21 MX computer system
- g. Two 9-track digital tape transports
- h. Calcomp 30 inch plotter
- i. Keyboard and line printers.

This system encountered intermittent problems during the FAY 019 cruise. These were of the following nature:

- a. Throughout the cruise lightning storms caused by local storms in the vicinity of Cape Hatteras caused intermittent loss of LORAN C signals.
- b. Early in the cruise, the Satellite receiving system had difficulty feeding its readings into the computer properly. In a few cases, periods of up to 20 hours passed without any satellite fixes. This problem was eventually traced to a timing problem in the Rubidium frequency standard and associated clock systems. While the INS system should be capable of  $\pm 100$  meter accuracy, the above problem could have resulted in a few cases where the position accuracy could have degenerated to  $\pm 500$  meters. A more complete analysis of this problem will be prepared after analysis of the navigation data.

Chronological Log FAY 019:

The FAY departed Charleston at 10:00AM local time (1400Z or GMT time) on 17 July 1976 in clear skies and very calm seas. At 1657Z we turned on to a course of 30° and began to deploy and test the 3.5 kHz sonar and minisparker systems. At 0141Z/18 July 76, the FAY turned into a course of 128° and began a long profile out to sea along CDP line #BT-1. The magnetometer was deployed by 0530Z and the airgun system was operational by 0600Z. Interference problems existed between the airgun, sparker, and 3.5 kHz systems and debugging these problems continued all the way out line BT-1. One problem arose after 1400Z when the ship headed off the shelf into deep water and neither the minisparker nor the 3.5 kHz system would delay properly to give suitable 1/2 second sweep programs in deep water. This was later identified as restricted to the two Raytheon recorders which would not center key without gating out the upper 1/4 second. No repairs made this possible, and so the 1/2 second sweep minisparker which was giving beautiful records in deep water was shifted to the one EPC Curley recorder, which did properly center key (also 1/4 and 3/4 keying positions). While the Raytheon recorder provides a somewhat better display, its failure to properly center key was a major limitation which should be remedied.

During 18 July the weather deteriorated and 4 to 6 foot seas developed with intermittent thunder showers and lightning storms causing problems on the LORAN C and magnetometer systems. Intermittent lightning storms became a normal condition throughout the Cape Hatteras region during this cruise, especially at night.

From 2010Z/19 July 76 to 0223Z/20 July 76 the FAY ran a course of 016° up to beginning the next line toward shore which was on a course of 308°. Good airgun records with 3 to 4 sec of penetration were achieved on this line. This line was completed at 1923Z/21 July 76. The next cross-shelf line began at 2338Z/21 July 76 and continued until 0400Z/23 July 76. The next line toward shore began at 1203Z/23 July 76 and ended at 1705Z/24 July 76. The airgun system was retrieved 2210Z/24 July 76 in preparation for a high speed run down the IPOD CDP line where only gravity, magnetometer, sparker, and bathymetry data were needed. The IPOD line out as far as shot point #4000 was completed at 0300Z/26 July 76.

From there, a line from IPOD up to DSDP Sites #105 and 106 and then to the seaward end of CDP line #6 was completed during 0530Z/26 July 76 and 1123Z/28 July 76 with excellent airgun and sparker profiles. At that point, the airguns were shut off for maintenance while the ship headed NE toward the seaward end of CDP line #5. Our objective was to run a line toward the southwest which would cross CDP line #6, 3, and IPOD. However, upon reaching the seaward end of CDP line #5 and starting the line, we encountered a 4 to 5 knot Gulf Stream current to the northeast which made it impossible to conduct the planned line.

Because of the Gulf Stream encountered at the seaward end of CDP line #5, it was decided to abandon that line and return to DSDP Site #106 and try a line from there to the seaward end of CDP line #3 and then down across IPOD in the

vicinity of IPOD Shot Point #2500. This plan was commenced at 1027Z/29 July 76. Excellent seismic profiles were obtained on this line which crossed IPOD and tied to the FAY 019 lines south of IPOD. This line parallel to the rise bathymetric contours was completed at 2301Z/31 July 76.

Time to complete only one diagonal and two cross shelf lines remained in the schedule. The airguns, magnetometer, and sparker were pulled for a high speed run up to the IPOD line. At 0500Z/1 Aug 76, we slowed to redeploy the airgun and sparker system and commence a diagonal line toward shore just north of Cape Hatteras. The magnetometer was not re-deployed at that time because an examination of excessive noise levels ( $\pm 2-3$  gammas) was needed. At 2030Z/1 Aug 76, the FAY had passed just north of Cape Hatteras and then changed course toward deep water on a course of  $116^\circ$ .

Between 2030Z/1 Aug 76 and 2005Z/2 Aug 76, the FAY traveled SE until crossing its previous track between IPOD and the end of CDP line #3. At 2005Z/2 Aug the FAY changed course to  $345^\circ$  on a dog leg before commencing its final profile towards shore. Between 0610Z/2 Aug and 0448Z/4 Aug 76, this long line was completed. The FAY then turned north ( $352^\circ$ ) toward Norfolk. At 1111Z/4 Aug, all seismic systems were aboard and the FAY headed in to Norfolk. The FAY tied up at the Moon Engineering Inc. docks of Norfolk at 1100 local (1500Z)/4 Aug 76.

#### Data Collected during FAY 019

<u>Type Data</u>	<u>Kilometers</u>
Airgun	3590
Gravity	4770
Magnetics	3940
Minisparker	4270
3.5 kHz	680

#### Illustrations

- Figure 1 - FAY 019 Gravity Tracks (Dock-to-dock)
- Figure 2 - FAY 019 Airgun Tracks
- Figure 3 - FAY 019 Minisparker Tracks
- Figure 4 - FAY 019 Magnetometer Tracks
- Figure 5 - FAY 019 3.5 kHz Sonar Tracks

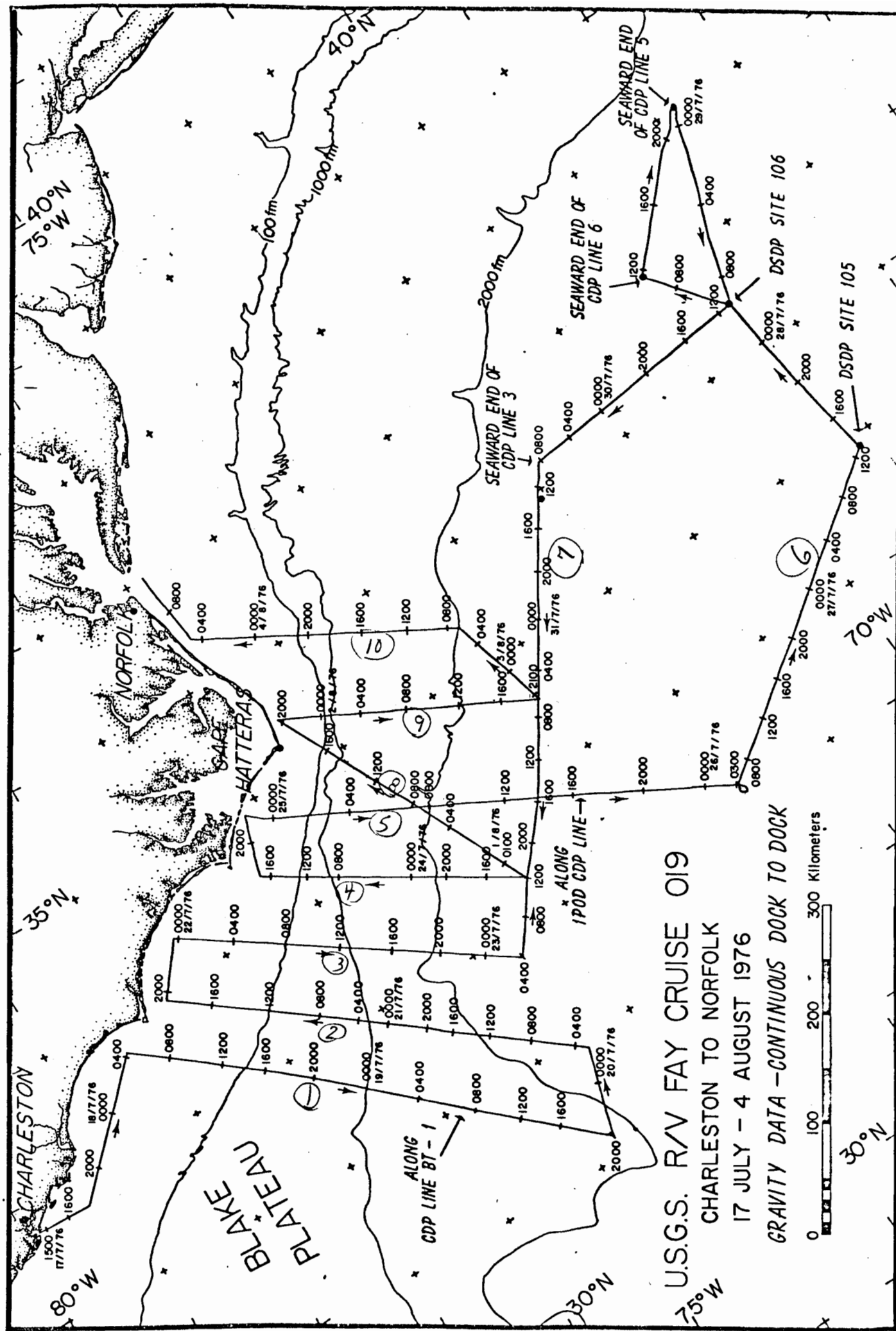


Figure 1

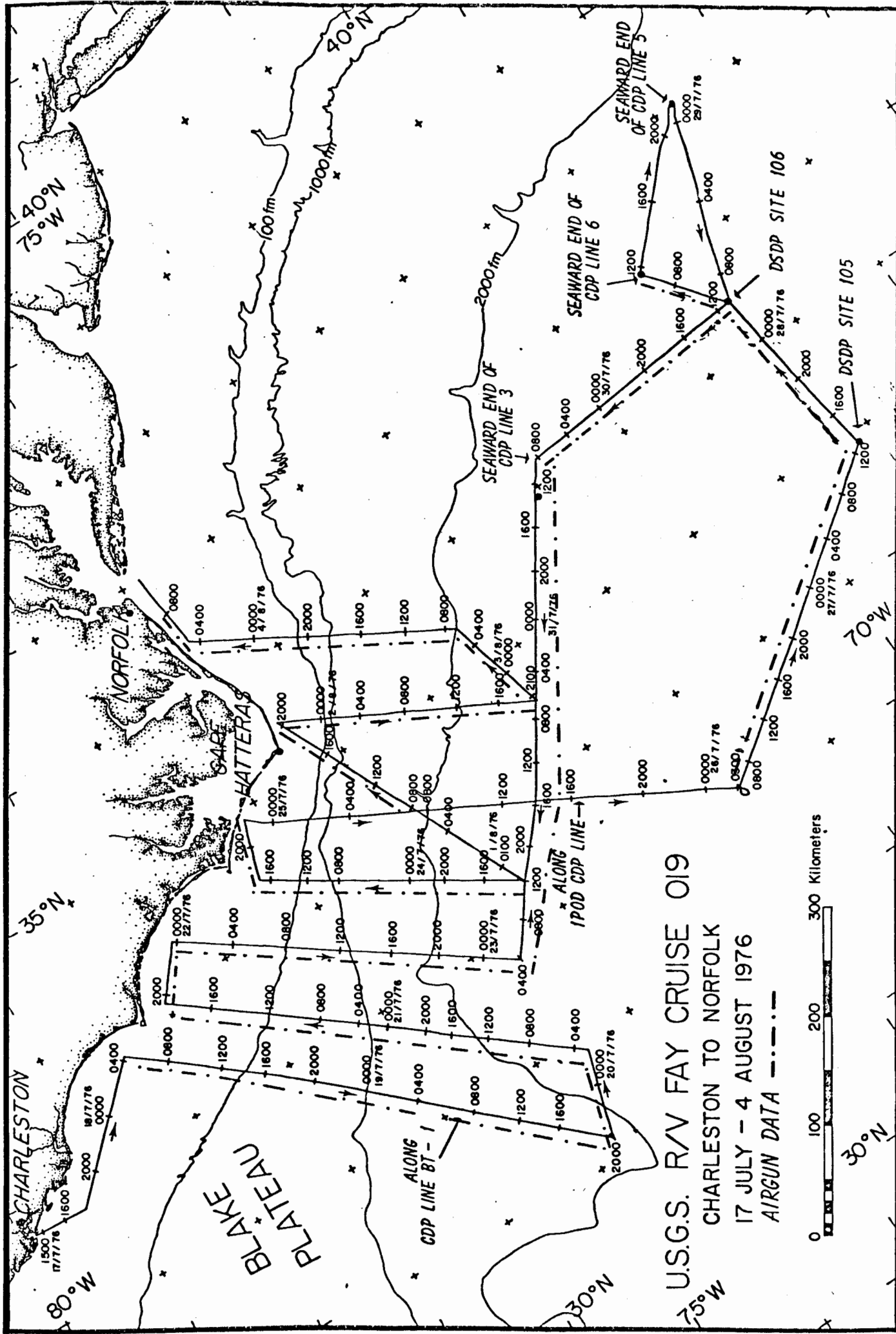


Figure 2

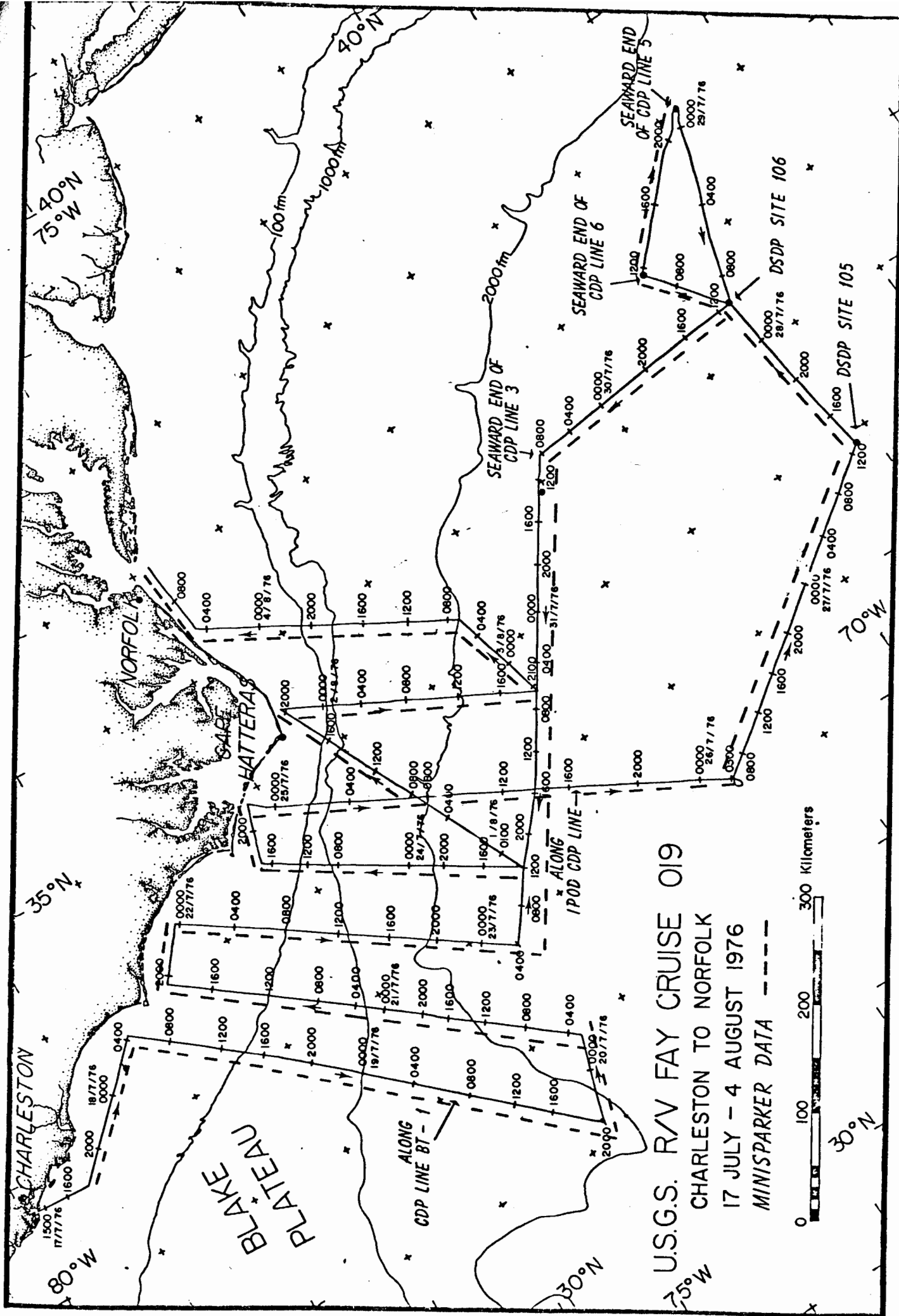


Figure 3



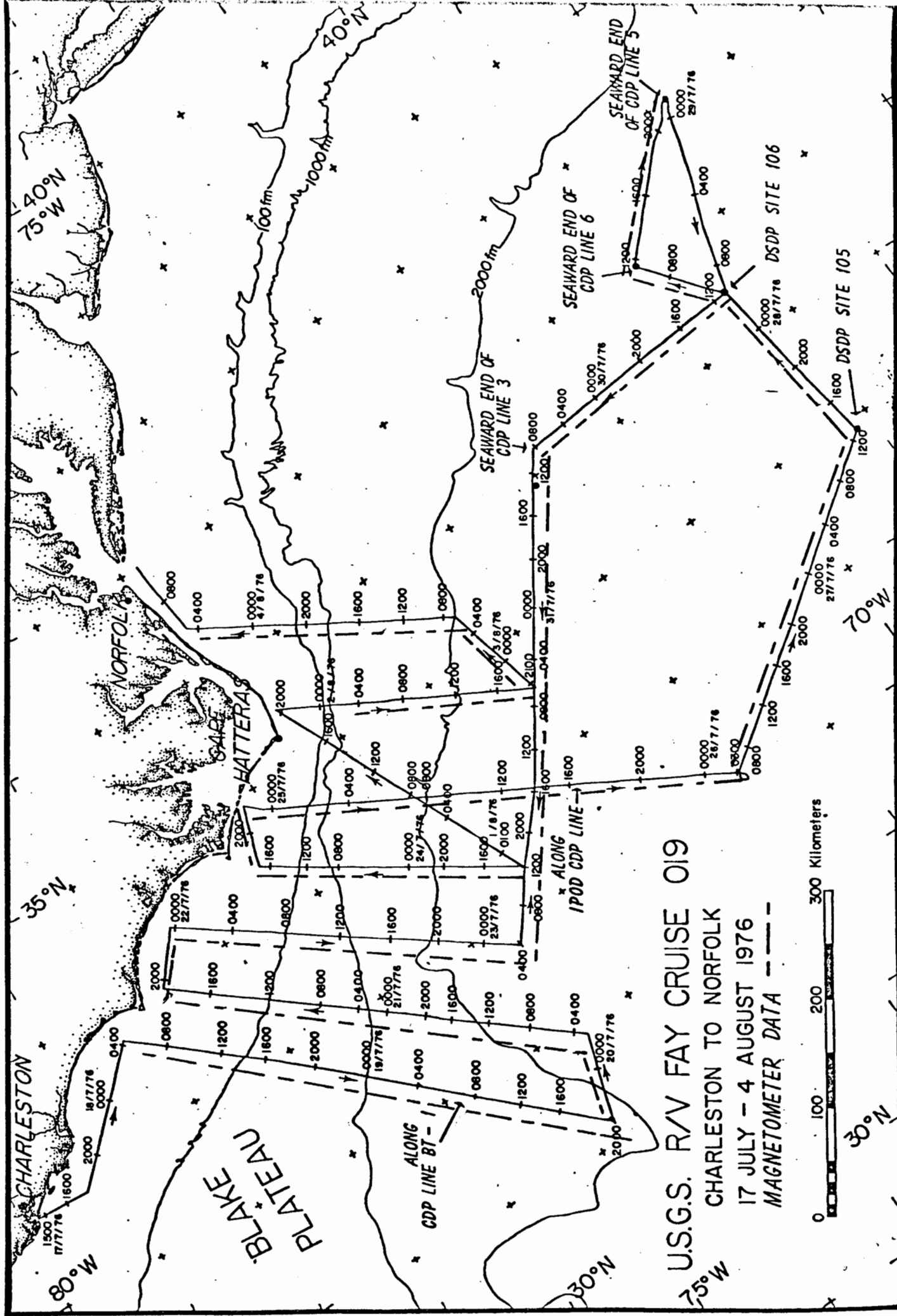
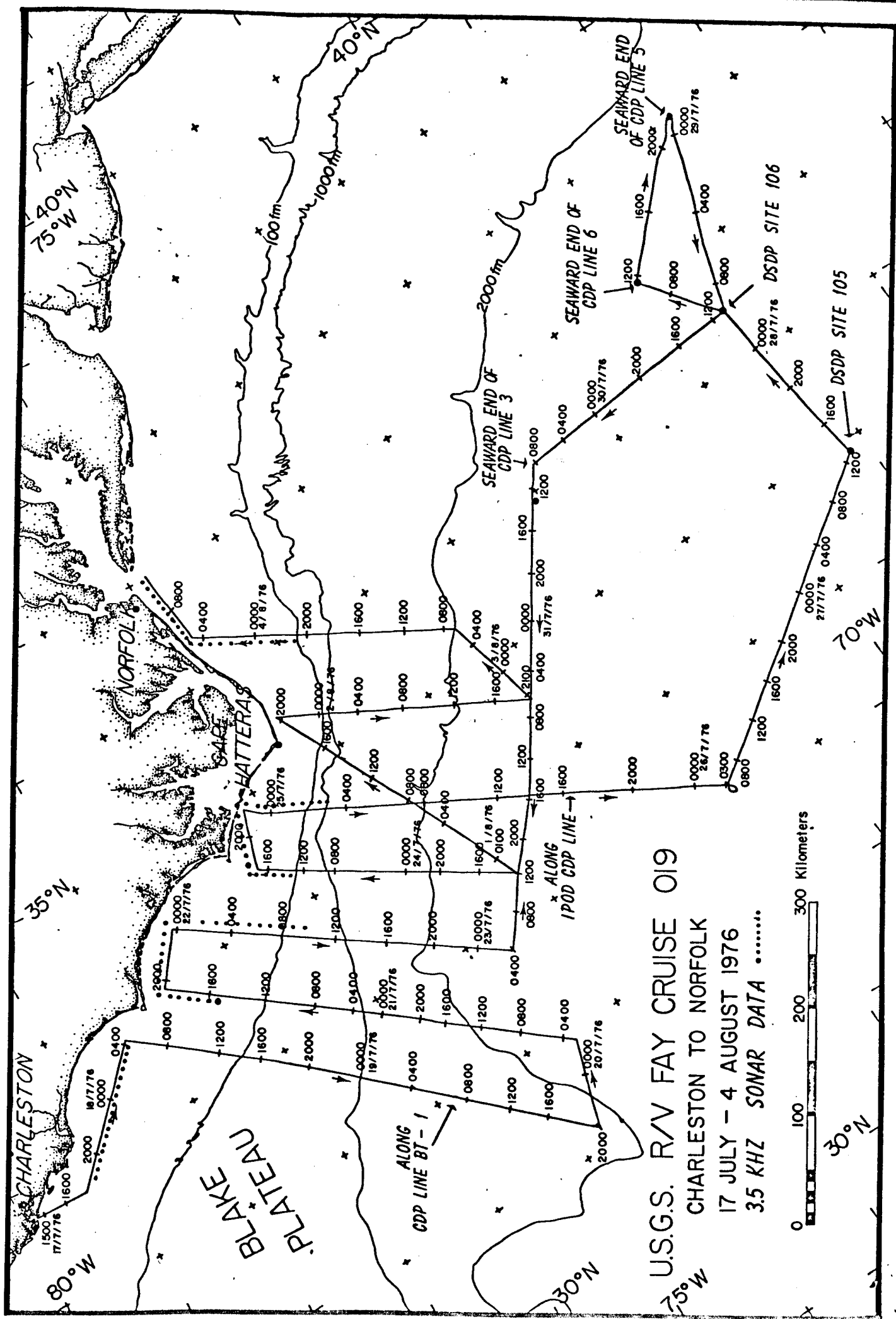


Figure 4



U.S.G.S. R/V FAY CRUISE 019

CHARLESTON TO NORFOLK

17 JULY - 4 AUGUST 1976

3.5 KHZ SONAR DATA .....

Figure 5